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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/008,531	01/16/1998	HOWARD E. RHODES	MIO012V2	6336

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10/22/2003

KILWORTH, GOTTMAN, HAGAN & SCHAEFF
ONE DAYTON CENTER
1 SOUTH MAIN STREET
SUITE 500
DAYTON, OH 45402-2023

EXAMINER

TRINH, MICHAEL MANH

ART UNIT

PAPER NUMBER

2822

DATE MAILED: 10/22/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/008,531

Applicant(s)

RHODES, HOWARD E.

Examiner

Michael Trinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 June 2003.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21-25,31 and 32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21-25,31 and 32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

*** This office action is in response to Applicant's Amendment filed on June 24, 2003.

Claims 21-25 and 31-32 are pending.

*** The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 102

1. Claims 21-24,31-32 are rejected under 35 U.S.C. 102(e) as being anticipated by Zamanian (5,793,111).

Zamanian teaches (at Figures 1-6 and cols 3-6) a method for forming a semiconductor device comprising at least the steps of: providing a substrate having at least one semiconductor layer 10,14 with inherent semiconductor gate electrode layers having opening including sidewalls formed thereon; forming an underlayer structure 36/32 having an opening in each of the underlayer (Fig 6) over the at least one semiconductor layer 10 and in the at least the semiconductor layer 32; forming a layer of conductive material 34 over the underlayer 36/32 and in the opening, the layer of conductive material 34 having a topography that includes a substantially vertical component located at the bottom of the opening (Figs 3-6) and defining a localized thick region thereon; forming an overlayer 40 over said layer of conductive material; etching to form a contact hole in the overlayer 40 and in an overetch amount extending into the substantially vertical component of the layer of conductive material 34 in the opening (Fig 6; col 5, line 50 through col 6), wherein the contact hole disposed adjacent to and directly contacting the vertical component of the layer of conductive material 34 in the opening; and forming a contact 44 in said contact hole disposed adjacent to, in the vertical component, and directly contacting the substantially vertical component in the conductive material layer 34 (Fig 6), and directly contacting the substantially vertical component in the conductive material layer 34 (Fig 6). Re further claim 31, providing a substrate having at least one semiconductor layer; forming opening in the at least semiconductor layer 34 (Figs 2-6); and forming a layer of conductive material 34 over the at least one semiconductor layer and in the opening.

Re claims 22 and 32, Zamanian shows the vertical component defining a localized thick region in the layer of conductive material.

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Re claim 23, Zamanian shows wherein layer of conductive material having the vertical component formed as a spacer.

Re claim 24, Zamanian forms a structure 28 having an opening therein under the conductive layer and filling the opening with the conductive material to form the vertical component.

Claim Rejections - 35 USC § 103

2. Claims 21-25,31-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuo et al (5,312,769) taken with Zamanian (5,793,111) and Toshiyuki et al (JP-05-109905).

In re claims 21, and 31, Matsuo shows in Figures 2A-2E and related text, a process for making a semiconductor device including the steps of providing a substrate having at least one semiconductor layer 1 and with semiconductor gate electrode layers having opening including sidewalls formed thereon; forming an underlayer structure 21 having an opening over and in the at least one semiconductor layer 102; forming over the underlayer structure and filling the opening with a layer of conductive material 12 having a topography that includes a substantially vertical component defining a localized thick region; forming an overlayer over said layer of conductive material; forming contact hole in the overlayer and in an overetch amount of the substantially vertical component; and forming a contact in said contact hole disposed adjacent to and directly contacting the substantially vertical component. Matsuo also shows wherein the contact hole window 29 is formed in the first interlayer insulating film 23 formed by using a dry etching technique (see Figure 2B; column 5, lines 30-46). Matsuo further shows in Figure 2B wherein the overlayer is made of oxide material and wherein the layer of conductive material is made of polysilicon (col 3, line 59 through col 5, line 55).

Matsuo fails to show etching in an overetch amount of the substantially vertical component.

However, Zamanian teaches (at Fig 6,1-5; col 5, line 50 through col 6, lines 22; cols 3-5) that in order to insure that all of the dielectric has been removed from the contact opening, etching a contact hole in the overlayer 40 and in an overetch amount of the layer of conductive material having a substantially vertical component. Toshiyuki et al (JP-05-109905) teaches (at Figs 1-4; English abstract and Computer-English Translation pages 1-3) forming a layer of conductive material 2 over an underlayer (Fig 2); forming an overlayer 3 over said layer of

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conductive material (Fig 2); etching to form a contact hole 9 in the overlayer 3 and in an overetch amount of the layer of the conductive material having a vertical component (Fig 3,1); and forming a contact 6,8 (Figs 1,4) in said contact hole 9 disposed adjacent to and directly contacting the substantially vertical component, in the layer of conductive material, and contacting the layer of conductive material 2.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the contact hole of Matsuo et al (Figure 2B) by etching a contact hole in the overlayer insulator 23 and in an overetch amount of the layer 12 of conductive material having a substantially vertical component, as combinatively taught by Zamanian and Toshiyuki, wherein the contact is formed in the overlayer and in said vertical component. This is because of the desirability to insure that all of the dielectric of the overlayer has been completely removed from the contact hole for providing a secure and good electrical connection from the layer of conductive material to the contact. This is also because of the desirability to improve reliability in the multilayer interconnection structure, and to suppress occupied area of a contact part between top and bottom wiring patterns.

Re claims 22 and 32, Matsuo et al shows the vertical component defining a localized thick region in the layer of conductive material.

Re claim 23, Matsuo shows wherein the vertical component is a spacer.

Re claim 24, Matsuo forms a structure 21 having an opening therein under the conductive layer 12 and filling the opening with the conductive material to form the vertical component.

Re claim 25, Matsuo shows wherein the contact 13 disposed adjacent to and contacting the vertical component 12 is a storage capacitor electrode made of the same material as the layer of conductive material (column 4, lines 3-22), in which the layer of conductive material is considered a part of the capacitor electrode.

3. Claims 21-25,31-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okada et al (5,399,890) taken with Zamanian (5,793,111) and Toshiyuki et al (JP-05-109905).

In re claims 21, and 31, Okada shows in Figures 2A-2C, 3, 5 and 6 and related text (col 6, lines 27 through col 8, line 8), a method for making a semiconductor device including the steps of: providing a semiconductor substrate having at least one semiconductor layer of gate

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electrodes; forming an underlayer structure 7a/7b,8 having an opening (Fig 5) over and in the at least one semiconductor layer 7a/7b (2B; col 6, lines 40-65); filling to form a layer of conductive material (9a in Fig 5; 9 in Fig 2C; 9b/9a in Fig 3) over the underlayer structure and in the opening formed in a semiconductor layer 7 (7a/7b in Fig 5), wherein the layer of conductive material 9a having a topography that includes a substantially vertical component in the opening and defining a localized thick region; forming an overlayer 10 over said layer of conductive material (col 7, lines 1-12); etching to form a contact hole 11 in the overlayer 10 and over the substantially vertical component; and forming a contact (over and in the conductive material 9a) in said contact hole of the overlayer 10 disposed adjacent to, in the substantially vertical component and directly contacting the vertical component of the layer of conductive material 9a as shown in Figure 5.

Okada et al fails to show etching in an overetch amount of the substantially vertical component of the layer of conductive material 9a (Fig 5).

However, Zamanian teaches (at Fig 6,1-5; col 5, line 50 through col 6, lines 22; cols 3-5) that in order to insure that all of the dielectric has been removed from the contact opening, etching a contact hole in the overlayer 40 and in an overetch amount extending into the layer of conductive material 34 (Fig 6) having a substantially vertical component, wherein the contact hole is etched in the overlayer 40, extending into the layer of conductive material and directly contacting the layer of conductive material 34. Toshiyuki et al (JP-05-109905) teaches (at Figs 1-4; English abstract and Computer-English Translation pages 1-3) forming a layer of conductive material 2 over an underlayer (Fig 2); forming an overlayer 3 over said layer of conductive material (Fig 2); etching to form a contact hole 9 in the overlayer 3 and in an overetch amount of the layer of the conductive material having a vertical component (Fig 3,1); and forming a contact 6,8 (Figs 1,4) in said contact hole 9 disposed adjacent to and directly contacting the substantially vertical component, in the layer of conductive material, and contacting the layer of conductive material 2.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the contact hole of Okada et al by etching a contact hole in the overlayer insulator and in an overetch amount extending into the layer of conductive material having a substantially vertical component, as combinatively taught by Zamanian and Toshiyuki, wherein

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the contact is formed in the overlayer and in said vertical component. This is because of the desirability to insure that all of the dielectric of the overlayer has been completely removed from the contact hole for providing a secure and good electrical connection from the layer of conductive material to the contact. This is also because of the desirability to improve reliability in the multilayer interconnection structure, and to suppress occupied area of a contact part between top and bottom wiring patterns.

Re claims 22 and 32, Okada et al shows the vertical component defining a localized thick region in the layer of conductive material.

Re claim 23, Okada shows wherein the vertical component is a spacer.

Re claim 24, Okada forms a structure 8 having an opening therein under the conductive layer and filling the opening with the conductive material to form the vertical component.

Re claim 25, Okada shows wherein the conductive layer 9 is a capacitor electrode (col 6, lines 1-10).

Response to Argument

4. Regarding 35 USC 102(e) rejection of claims 31-32 using the Okada reference (5,399,890), Applicant's amendment and remarks filed on June 24, 2003 have been overcome the 102 rejection, since Okada does not anticipatively teach at least forming a contact hole in the overlayer and extending into the vertical component of the layer of conductive material, the contact hole disposed adjacent to and directly contacting the vertical component in the opening.

5. Applicant's amendment and other remarks filed on June 24, 2003 have been considered but they are not persuasive and also in moot of new ground of rejections.

*** Claimed subject matter, not the specification, is the measure of invention.

Limitations in the specification cannot be read into the claims for the purpose of avoiding the prior art. In *Re Self*, 213 USPQ 1,5 (CCPA 1982); In *Re Priest*, 199 USPQ 11,15 (CCPA 1978).

*** Regarding Zamanian reference: Applicant remarked (at page 3-4)) that in Zamanian, "...if barrier layer 34 is the 'layer of conductive material' ..". then it does not have a substantially vertical component..."

In response, it is noted and found unconvincing. In Zamanian (5,793,111), as shown in Figure 3-6, a barrier layer of conductive material 34 is having a topology that includes a

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substantially vertical component” located at the bottom of the opening (Fig 6) and defining a localized thick region thereon. As shown in Figure 6, the conductive 44 is directly contacting the substantially vertical component of the conductive material layer 34 and in the substantially vertical component of the conductive material layer, wherein a contact hole is etched in the overlayer 40 and extending into the substantially vertical component of the layer of conductive material 34, wherein the contact hole disposed adjacent to and directly contacting the substantially vertical component in the opening.

*** Regarding 35 USC 103 rejection using Matsuo as a main reference:

Applicant remarked that “...Zamanian’s conductive layer 32 of polysilicon is not etched at all...”

In response, it is noted and found unconvincing, since Zamanian clearly teaches over-etching of the underlying layer of conductive material 34 (Fig 6) during formation of the contact hole. Moreover, overetching as claimed by the present invention is not different from over-etching as taught by Zamanian and Wolf. Claimed subject matter, not the specification, is the measure of invention. Limitations in the specification cannot be read into the claims for the purpose of avoiding the prior art. In *Re Self*, 213 USPQ 1,5 (CCPA 1982); In *Re Priest*, 199 USPQ 11,15 (CCPA 1978). Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the contact hole of Matsuo et al by etching a contact hole in the overlayer insulator and in an overetch amount of the layer of conductive material having a substantially vertical component, as taught by Zamanian, wherein the contact hole is formed in the overlayer and extending into an overetched amount of the layer of conductive material. This is because of the desirability to insure that all of the dielectric of the overlayer has been completely removed from the contact hole for providing a secure and good electrical connection from the layer of conductive material to the contact.

*** Regarding Okada in view of Zamanian and Toshiyuki:

Applicant’s main remark (at remark page 6) that “...Okada does not teach forming a structure having an opening in a semiconductor layer and filling the opening with a layer of conductive material...”.

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In response, this is noted and found unconvincing. As also shown in Figure 5, there is at least a structure having an opening in a semiconductor layer 7 (7a/7b in Fig 5), wherein the opening is filled with a layer of conductive material 9a (Fig 5). Additionally, as shown in Figure 5, 2C, 6A-6B, there is an opening formed in the insulating layer 8. Claimed subject matter, not the specification, is the measure of invention. Limitations in the specification cannot be read into the claims for the purpose of avoiding the prior art. In *Re Self*, 213 USPQ 1,5 (CCPA 1982); In *Re Priest*, 199 USPQ 11,15 (CCPA 1978).

Under 35 USC 103 rejection, the main reference of Okada clearly teaches forming an underlay having an opening and a conductive material that has a substantially vertical component. It would have been obvious to one of ordinary skill in the art to have modified the method of Okada since the reference of Zamanian and Toshiyuki teach overetching the underlying wiring layer during formation of the contact hole.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

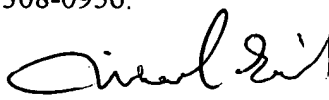
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael M. Trinh whose telephone number is (703) 308-2554. The examiner can normally be reached on M-F from 8:30 Am to 4:30 Pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (703) 308-4905. The fax phone numbers for the organization where this application or proceeding is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Oacs-04-44



Michael Trinh
Primary Examiner